

Using NGS Online Positioning User Service (OPUS)

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Introduction

Online Positioning User Service (OPUS) allows users to submit their RINEX (**R**eceiver **I**ndependent **E**xchange) format GPS data files online to the National Geodetic Survey (NGS), where the data will be processed to determine a position using NGS computers and software. Each RINEX file that is submitted will be processed with respect to 3 [National CORS](#) sites. The resulting position is automatically e-mailed back to the user. You do not need software for baseline processing or least squares adjustment software on your computer. You only need to download the file from your GPS receiver, convert to RINEX format, and submit online to NGS.

At this time, NGS requires that you use a **dual-frequency** GPS receiver; however, they have a plan to allow single-frequency receiver data in the future.

NGS requires a **minimum** of two hours of data per file, but recommends at least four hours of data. To comply with BLM Cadastral GPS standards, I recommend doing **two** four-hour sessions, breaking down your tripod and setting up again in between sessions in order to achieve an *independent occupation* with an independent antenna height measurement.

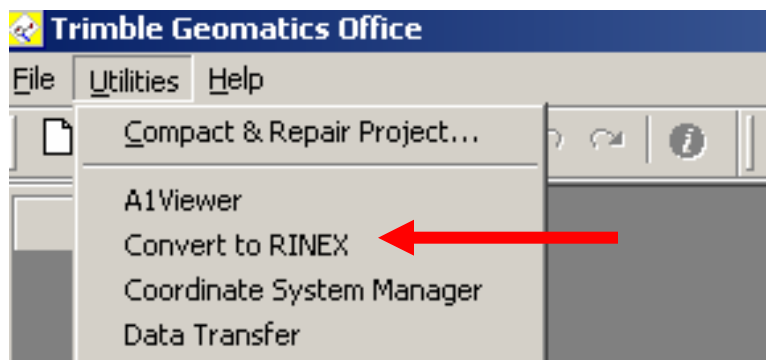
You must download the files from the GPS receiver, convert the file to RINEX format, and then submit the RINEX file to NGS via the OPUS on-line submittal form.

The following instructions assume a Trimble .dat file and Trimble Geomatics Office (TGO) software; however, the executable for "Convert to RINEX" in TGO is "**dat2rinw.exe**", which can be run as a stand alone program without TGO. Dat2rinw.exe, which is typically located in C:\Program Files\Common Files\Trimble\DatToRinex\dat2rinw.exe.

According to the NGS, UNAVCO has developed software called TEQC (pronounced TEK) that is freely available at <http://www.unavco.org/facility/software/teqc/teqc.html>. TEQC will convert data files to RINEX format, but I have not used the TEQC software.

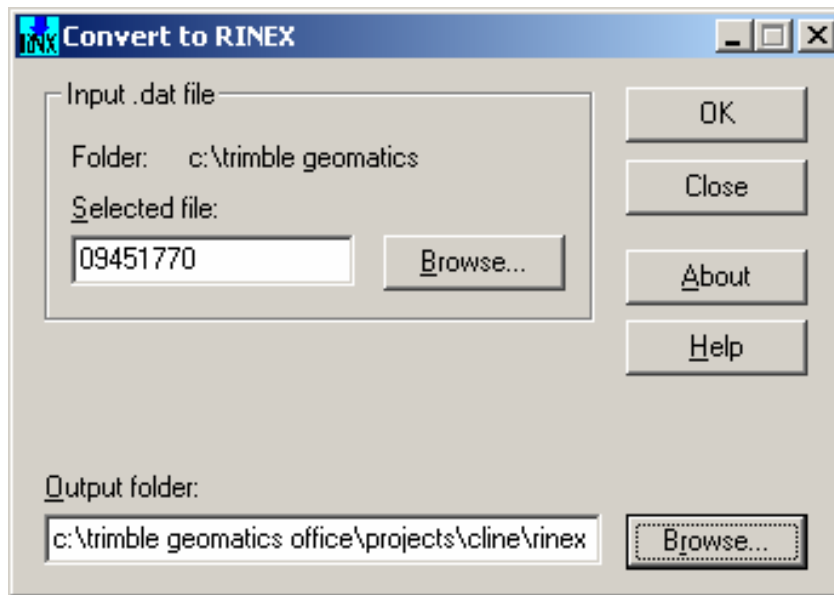
Converting the downloaded Trimble .dat file to a RINEX file in TGO.

1. Using Trimble Geomatics Office (TGO), with all projects closed; pick "**Convert to RINEX**" from the "**Utilities**" menu.

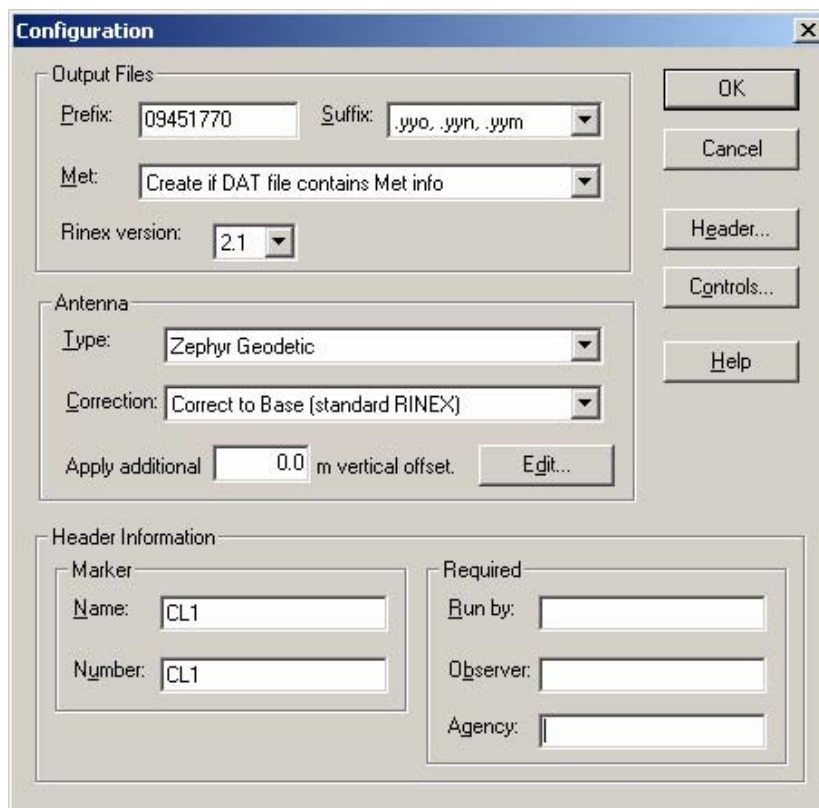


2. In the “**Convert to RINEX**” window, browse to the .dat file you want to convert to RINEX.

Also, in the “**Convert to RINEX**” window, browse to the output folder where you want to send the RINEX file, then click “**OK**”.



3. This will open the “**Configuration**” window shown below:



4. In the “**Configuration**” window under “**Output Files**”, it is recommended to change the “**Prefix**” to AAAAJJJX, where AAAA is a four character station name, JJJ is the Julian day, and X is the session number during that Julian day.

Set the “**Suffix**” to “.yyo,.yyn,.yym”

Set the “**Met**” to “Create if DAT file contains Met info”, or “Do not create.”

Under “**Antenna/Type**”, use the pull-down menu to choose the correct antenna that you used.

Under “**Antenna/Correction**” choose “**Correct to Base (standard RINEX)**”. This corrects the antenna height measurement to the antenna reference point (**ARP**) of the antenna.

Under “**Header Information**” change the “**Name**” to the same as what you put for the output file prefix.

Fill in the “**Required**” info for who the RINEX conversion was “**Run by**”, who the GPS “**Observer**” was, and the acronym of the “**Agency**” of the observer.

When finished, click ‘**EDIT**’ in the ‘**Antenna**’ portion of the window.

The screenshot shows the 'Configuration' dialog box with the following settings:

- Output Files:**
 - Prefix: CL1_1770
 - Suffix: .yyo, .yyn, .yym
 - Met: Create if DAT file contains Met info
 - Rinex version: 2.1
- Antenna:**
 - Type: Zephyr Geodetic
 - Correction: Correct to Base (standard RINEX)
 - Apply additional: 0.0 m vertical offset
 - Edit... button (highlighted with a red arrow)
- Header Information:**
 - Marker:
 - Name: CL1_
 - Number: CL1_
 - Required:
 - Run by: KWB
 - Observer: KWB
 - Agency: BLM

Buttons on the right: OK, Cancel, Header..., Controls..., Help.

5. In the “**Edit Antenna Height**” window, choose the “**Measurement Method**” that you used for measuring your antenna height in the field, in this example, “Bottom of Notch on Ground Plane”.

Enter “**Original antenna height**”, as measured in the field, and then click “**Correct**”.

Occupation 1 of 1

Marker name: 95942970

Measurement method:
Bottom of notch on ground plane

Original antenna height: 2.0000 m

Corrected antenna height: 0.0000 m

<- Previous Next ->

OK
Cancel
Correct

5. The “**Corrected antenna height**” will be computed:

Occupation 1 of 1

Marker name: CL1

Measurement method: Bottom of notch

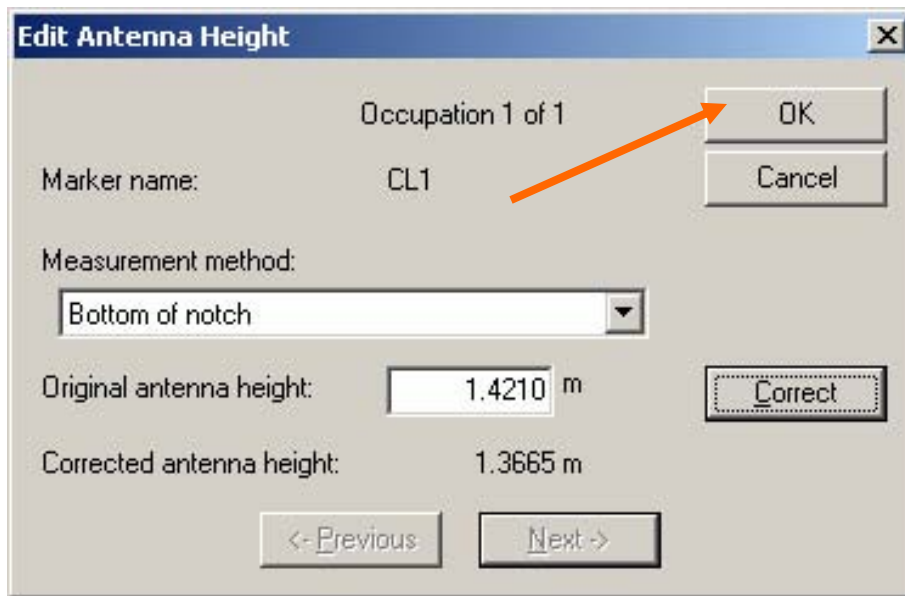
Original antenna height: 1.4210 m

Corrected antenna height: 1.3665 m

Buttons: OK, Cancel, Correct, <- Previous, Next ->

Write this “Corrected Antenna Height” down. You will need this number to enter as the “Antenna Height” when you submit the RINEX file on-line to NGS. It is the vertical measurement, not the slant measurement, from the survey mark to the Antenna Reference Point (ARP), which is almost always the center of the bottom-most, permanently attached portion of the antenna. Although this antenna and height information will be in the RINEX file you create, **OPUS does not read the header of the RINEX file for antenna or height information.** You need to manually enter the corrected antenna height into the on-line submission form for OPUS.

8. In the **"Edit Antenna Height"** window, click **"OK"**

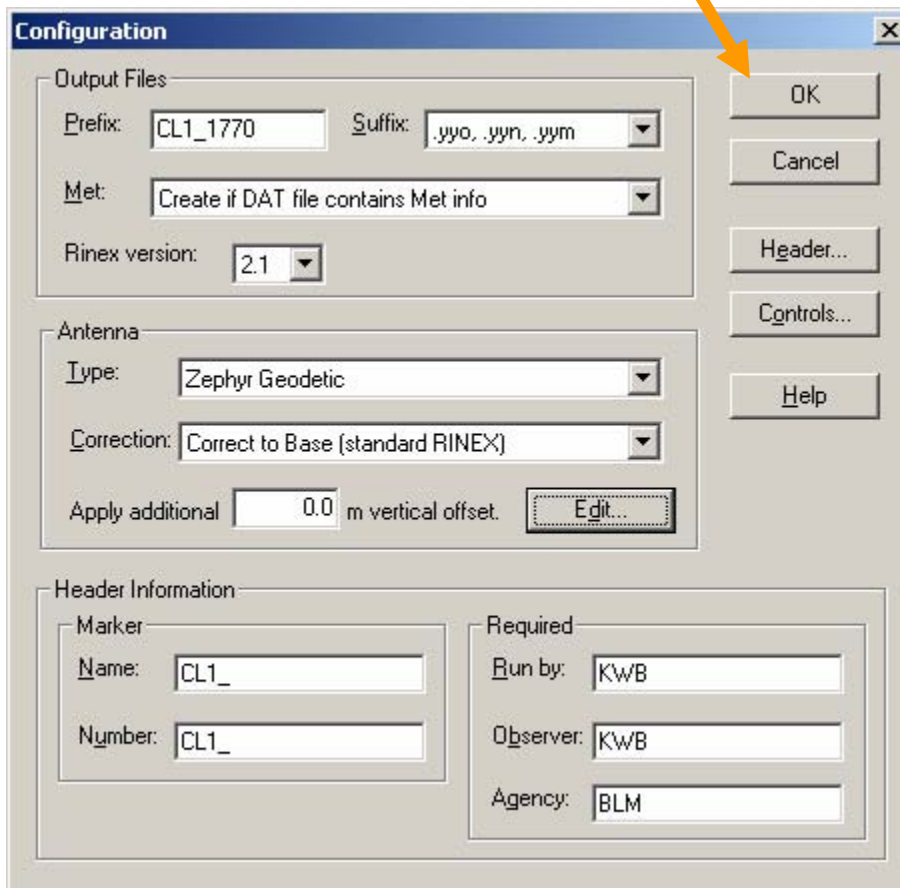


The "Edit Antenna Height" dialog box shows the following information:

- Occupation 1 of 1
- Marker name: CL1
- Measurement method: Bottom of notch
- Original antenna height: 1.4210 m
- Corrected antenna height: 1.3665 m

Buttons include: OK, Cancel, Correct, <- Previous, and Next ->. An orange arrow points to the OK button.

9. In the **"Configuration"** window, click **"OK"**

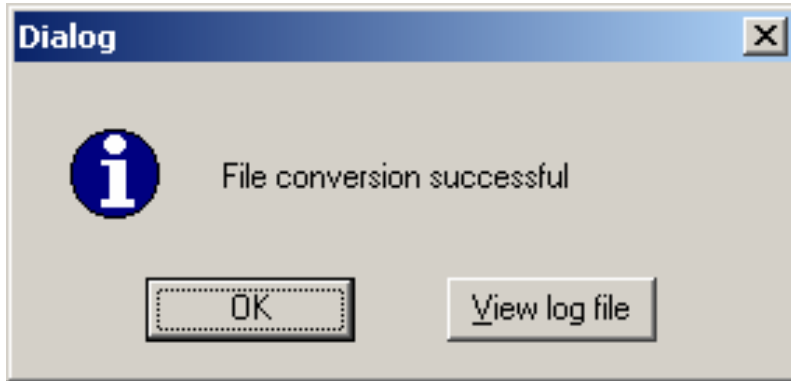


The "Configuration" dialog box contains the following settings:

- Output Files:**
 - Prefix: CL1_1770
 - Suffix: .yyo, .yyh, .yym
 - Met: Create if DAT file contains Met info
 - Rinex version: 2.1
- Antenna:**
 - Type: Zephyr Geodetic
 - Correction: Correct to Base (standard RINEX)
 - Apply additional 0.0 m vertical offset
- Header Information:**
 - Marker Name: CL1_
 - Marker Number: CL1_
 - Required Run by: KWB
 - Observer: KWB
 - Agency: BLM

Buttons include: OK, Cancel, Header..., Controls..., and Help. An orange arrow points to the OK button.

10. You should get the message below if your conversion is successful.



Three RINEX files are created, an **observation file** with the file extension having the 2 digit year and the letter "o", e.g., site3650.99o , a navigation file with the extension having the 2 digit year and an "n", e.g. site3650.99n, and a met file with the extension having the 2 digit year and an "m", e.g. site3650.99m.

You **only** need to submit the **observation** file to OPUS, not the other two files.



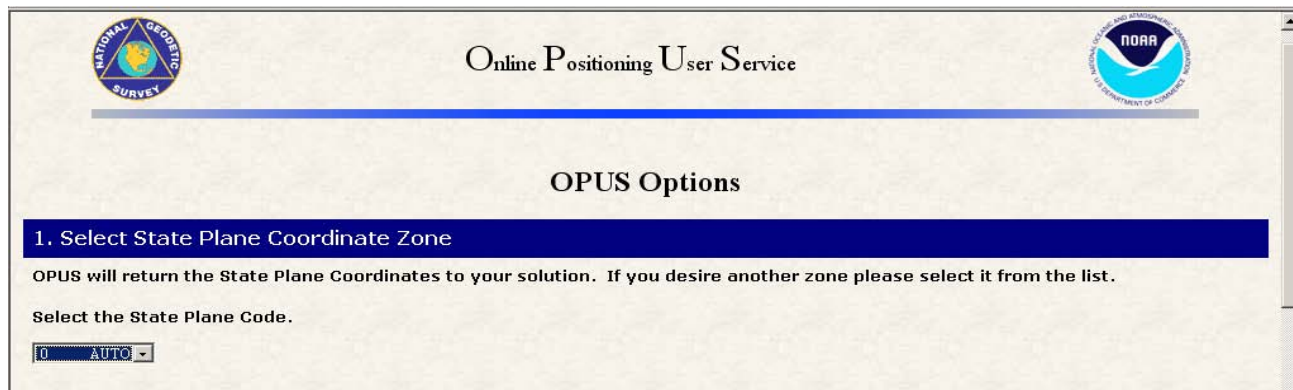
OPUS allows users to submit compressed GPS data (.ZIP, .zip, .Z, .gz) as well as uncompressed GPS data, so you may wish to zip your RINEX file before submittal to OPUS. If you are pkzipping your file, the "archive" name must have the same name as the rinex file that it contains. For example, **site3650.99o.zip** must contain file **site3650.99o** only.

Submitting the RINEX File to NGS:

1. Using a browser, go to URL: <http://www.ngs.noaa.gov/OPUS/>
2. Complete the on-line submittal form as follows:
 1. Your E-mail address.
 2. Browse to the RINEX **observation file** .yyo that you created. OPUS allows users to submit compressed GPS data (.ZIP, .zip, .Z, .gz) as well as uncompressed GPS data. If you are pkzipping your file, the "archive" name must have the same name as the rinex file that it contains. For example, **site3650.99o.zip** must contain file **site3650.99o** only.
 3. Choose your antenna type from the pull-down menu. The pick list has the description and part numbers of Trimble dual frequency antennas, so check the part number on your antenna.
 4. Enter the **Corrected Antenna Height** that you wrote down above when converting to RINEX . This is the vertical measurement to the Antenna Reference Point (ARP). You must supply this vertical measurement because OPUS does not read the header of the RINEX for antenna or height information.

5. Click on “Options”.

6. Optionally, choose State Plane Coordinate output if you want them in addition to geographic and UTM coordinates. You can choose which State Plane zone let OPUS figure out which zone you are in by choosing "0 Auto".



Online Positioning User Service

OPUS Options

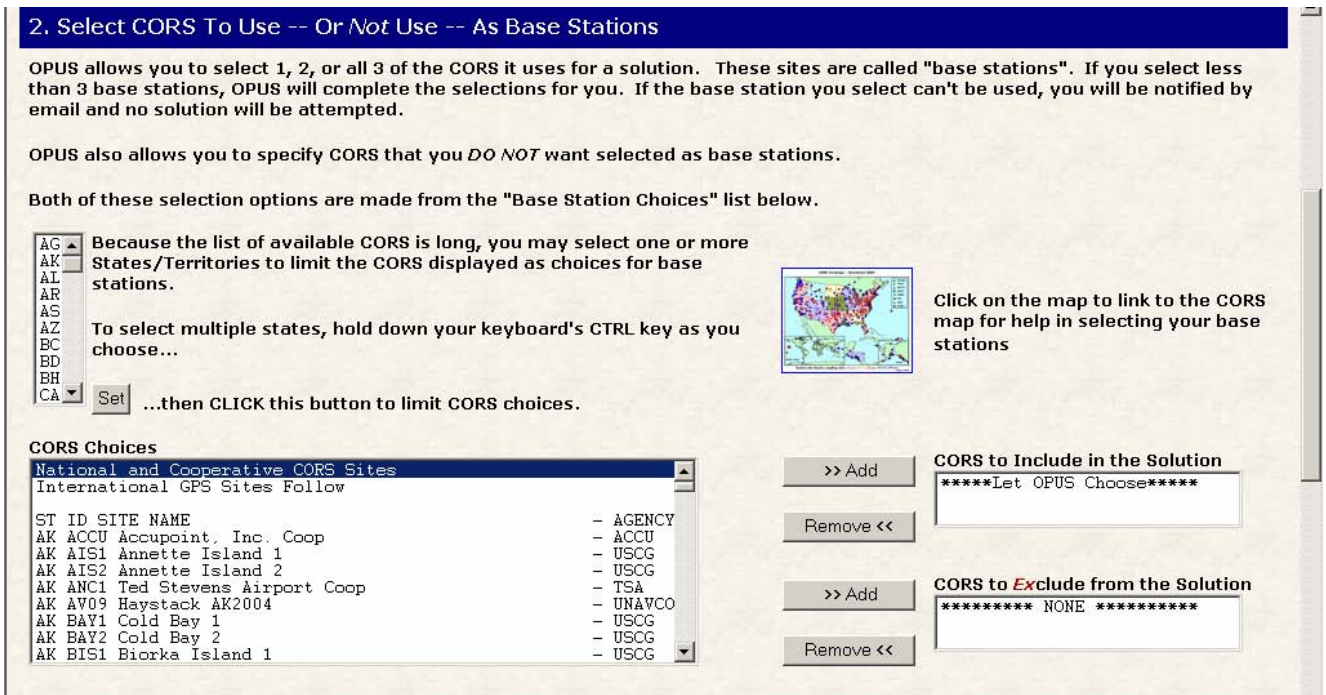
1. Select State Plane Coordinate Zone

OPUS will return the State Plane Coordinates to your solution. If you desire another zone please select it from the list.

Select the State Plane Code.

0 AUTO

7. Let OPUS automatically choose the 3 base stations, or optionally pick them yourself. You can also specify base station you don't want to use. If you "Let OPUS choose", OPUS will screen the CORS base stations it uses for data availability, data quality, etc.



2. Select CORS To Use -- Or Not Use -- As Base Stations

OPUS allows you to select 1, 2, or all 3 of the CORS it uses for a solution. These sites are called "base stations". If you select less than 3 base stations, OPUS will complete the selections for you. If the base station you select can't be used, you will be notified by email and no solution will be attempted.

OPUS also allows you to specify CORS that you *DO NOT* want selected as base stations.

Both of these selection options are made from the "Base Station Choices" list below.

Because the list of available CORS is long, you may select one or more States/Territories to limit the CORS displayed as choices for base stations.

To select multiple states, hold down your keyboard's CTRL key as you choose...

Set ...then CLICK this button to limit CORS choices.

CORS Choices

National and Cooperative CORS Sites
International GPS Sites Follow

ST	ID	SITE NAME	
AK	ACC1	Accupoint, Inc. Coop	- AGENCY
AK	AIS1	Annette Island 1	- ACCU
AK	AIS2	Annette Island 2	- USCG
AK	ANC1	Ted Stevens Airport Coop	- USCG
AK	AV09	Haystack AK2004	- TSA
AK	BAV1	Cold Bay 1	- UNAVCO
AK	BAV2	Cold Bay 2	- USCG
AK	BIS1	Biorka Island 1	- USCG

Click on the map to link to the CORS map for help in selecting your base stations

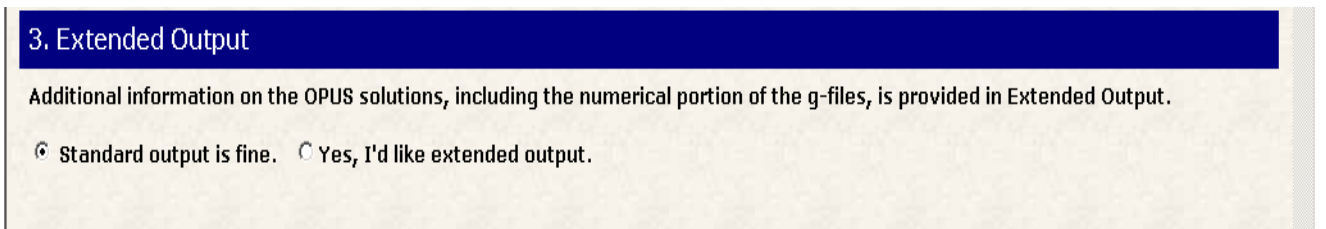
CORS to Include in the Solution

****Let OPUS Choose****

CORS to Exclude from the Solution

***** NONE *****

7. Choose "Standard Output":

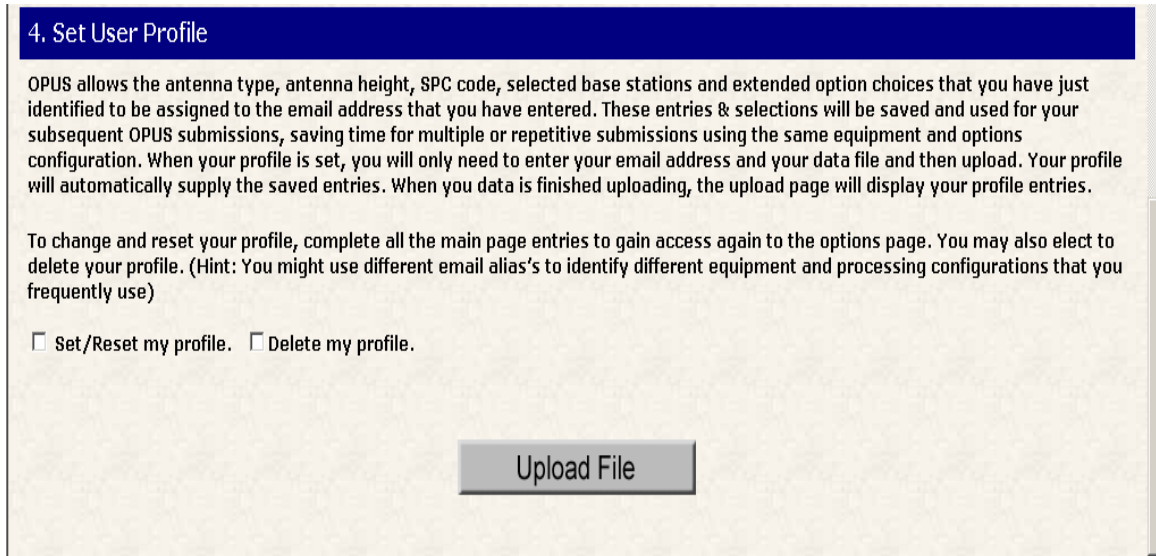


3. Extended Output

Additional information on the OPUS solutions, including the numerical portion of the g-files, is provided in Extended Output.

☒ Standard output is fine. ☐ Yes, I'd like extended output.

8. You can have OPUS set a user profile for you, which saves your preferences; however, be careful, because the profile will save your antenna type and antenna height, which may change unless you use fixed height tripods and always the same antenna:



4. Set User Profile

OPUS allows the antenna type, antenna height, SPC code, selected base stations and extended option choices that you have just identified to be assigned to the email address that you have entered. These entries & selections will be saved and used for your subsequent OPUS submissions, saving time for multiple or repetitive submissions using the same equipment and options configuration. When your profile is set, you will only need to enter your email address and your data file and then upload. Your profile will automatically supply the saved entries. When your data is finished uploading, the upload page will display your profile entries.

To change and reset your profile, complete all the main page entries to gain access again to the options page. You may also elect to delete your profile. (Hint: You might use different email alias's to identify different equipment and processing configurations that you frequently use)

☐ Set/Reset my profile. ☐ Delete my profile.

Upload File

7. Once this information is complete, click the “**Upload File**” button to send your data to NGS. You may upload multiple data files in a zip archive; however, again, be careful, because the same options will be applied to **all** data files, including antenna height.

8. A pop-up on your browser will appear confirming that the file is being uploaded:



9. Then another NGS OPUS web page will show the upload status.

10. The **OPUS solution report** will be e-mailed back to you within a few minutes.

NGS OPUS Solution Report:

See http://www.ngs.noaa.gov/OPUS/Using_OPUS.html for a full description of the OPUS output page.

OPUS will output positions in the latest ITRF and NAD83 (CORS) datums.

NOTE: NAD83(CORS96) datum is equivalent to NAD83(98) datum, the datum used for the High Accuracy GPS Reference Network (HARN) here in Oregon.

For archiving, I recommend that you print the solution report for your records and also save the report as a digital text file.

FILE: CL1_1770.03o 000231316

NGS OPUS SOLUTION REPORT

=====

USER: ken_bays@or.blm.gov DATE: November 22, 2004
RINEX FILE: cl1_177t.03o TIME: 21:19:16 UTC
SOFTWARE: page5 0411.19 master16.pl START: 2003/06/26 19:03:00
EPHEMERIS: igs12244.eph [precise] STOP: 2003/06/26 22:33:00

Note: The *precise* ephemeris, available in 10-14 days, is best, but the *rapid* ephemeris, available in 24 hours, yields OPUS results with essentially no difference in accuracy. The third type of orbit is an *ultra-rapid* ephemeris, which is a predicted orbit and available almost immediately; however, it is not as reliable as a *precise* or *rapid* ephemeris. Therefore, it is best to wait one day to submit your file to NGS OPUS so that your the OPUS solution will use a *rapid* ephemeris.

NAV FILE: brdc1770.03n OBS USED: 6253 / 6352 : 98%
(NGS says a good run should use at least 90% of your observations.)

ANT NAME: TRM41249.00 # FIXED AMB: 30 / 33 : 91%
(NGS says you should have at least 50% of your ambiguities fixed.)

ARP HEIGHT: 1.3665 OVERALL RMS: 0.015 (m)
(NGS says your overall RMS should not exceed 0.03 M)

REF FRAME: **NAD83 (CORS96) (EPOCH:2002.0000)** ITRF00 (EPOCH:2003.4845)
(Note: Same as NAD83(98))

X:	-2377319.289 (m)	0.018 (m)	-2377319.979 (m)	0.018 (m)
Y:	-3910378.897 (m)	0.087 (m)	-3910377.687 (m)	0.087 (m)
Z:	4429507.226 (m)	0.039 (m)	4429507.301 (m)	0.039 (m)

LAT:	44 15 30.06575	0.030 (m)	44 15 30.08276	0.030 (m)
E LON:	238 42 8.79418	0.043 (m)	238 42 8.73927	0.043 (m)
W LON:	121 17 51.20582	0.043 (m)	121 17 51.26073	0.043 (m)
EL HGT:	1161.762 (m)	0.087 (m)	1161.330 (m)	0.087 (m)

ORTHO HGT: 1183.046 (m) 0.091 (m) [Geoid03 NAVD88]

(Note: Error estimates after each coordinate are peak-to-peak error, which normally should not exceed 0.05 m for horizontal coordinates, according to NGS.)

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 10)	SPC (3602 OR S)
Northing (Y) [meters]	4901977.292	288214.696
Easting (X) [meters]	635898.725	1436305.331
Convergence [degrees]	1.18830734	-0.54564664
Point Scale	0.99982713	1.00007595
Combined Factor	0.99964503	0.99989381

US NATIONAL GRID DESIGNATOR: 10TFQ3589901977 (NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE (m)
AF9636	GWEN APPLETON CORS ARP	N454657.461	W1211939.167	169433.4
AH2507	REDM REDMOND CORS ARP	N441535.145	W1210852.316	11959.2
AF9664	GOBS GOLDENDALE OBSER. CORS ARP	N455019.729	W1204852.777	179732.7
NEAREST NGS PUBLISHED CONTROL POINT				
QD1723	CLINE	N441511.462	W1211810.517	716.8

This position was computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.